



Stockroom 160 liter Liquid Argon Dewar

491.2 lb. or 222.8 kg Argon

4750 ft³ or 134,560 liters warm gas

1 ppm O₂ by volume = 0.18 g O₂ (observed)

1 ppm O₂ by weight = 0.22 g O₂

10 ppm H₂O by molar fraction = 1.0 g H₂O (literature, maximum)

Molecular sieve with Sigma-Aldrich 5A material

8 x 12 mesh (1.68 to 2.38 mm diameter beads)

Surface area of ~570 m²/gram

1.72 Liter volume, 1212 grams of filter material

H₂O adsorption (warm) may be as high as 21.7% by weight or 263 grams H₂O

MVE Test Cryostat

178 liter volume, 546.5 lb or 247.9 kg

Cannot fill beyond 145.5 liters, 446.7 lbs. or 202.6 kg

100 ppt O₂ by weight in 145.5 liters is 2.026x10⁻⁵ g or 0.0153 cm³ gas.

Evacuated to 2 x 10⁻⁶ Torr prior to filling. If remaining gas was all air, then O₂ fraction would be 1.30x10⁻⁷ g or 9.84x10⁻⁵ cm³. However, remaining gas is mostly water vapor.

Cryostat surface area = 19,468 cm²

Ratio of volume to surface area = 109 cm²/Liter

A monolayer of oxygen covering the entire cryostat surface area would contain 5.17x10⁻⁴ g of oxygen which is an equivalent contamination removal of 2.5 ppb. Icarus claims 1/10 of a monolayer can form.

O₂ filter with Engelhard Copper Alumina Catalyst CU-0226S

14 x 20 mesh (0.841 to 1.41 mm diameter beads)

Surface area of 200 m²/gram

1.72 Liter volume, 1393 grams of filter material

Filter O₂ capacity for FLARE purity requirements is unknown.

Filter dynamic capacity is flow rate dependent.

1.72 liters of atmospheric air contains 0.478 g O₂.

H₂O adsorption (warm) may be as high as 25% by weight or 348 grams

H₂O (Trigon customer experience)

1.72 liters of atmospheric air with a 5 °C dew point contains 0.01 g H₂O.

During regeneration 1.125 g H₂O is produced for each gram of O₂ removed from filter.

Filtering 2Cu_(s) + O_{2(g)} → 2CuO_(s)

Regeneration CuO_(s) + H_{2(g)} → Cu_(s) + H_{2O(g)}

Filter contains 10% Cu by weight, or 139.3 grams. If all the Cu could be reacted, 35.0 g O₂ would be removed from the Argon.

Relationship between H₂O adsorption and O₂ capacity is unknown.

Flow rate thru filter was 48.8 volume changes per hour without molecular sieve and 34.8 volume changes per hour (1.0 LPM) with molecular sieve
At 1 LPM flow velocity in filter is 1.35 ft/min.

Stockroom 160 liter Liquid Argon Dewar Specs

Airgas spec is

< 20 ppm N₂

< 5 ppm O₂

< 1 ppm total hydrocarbons

-76 deg. F dew point (10 ppm H₂O)

Airgas does NOT evacuate dewars before filling. It is possible for a user to contaminate the dewar and the contamination to be passed on.